A MANUAL

OF THE

COLLODION PHOTOGRAPHIC PROCESS.

BY

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PREFACE.

THE Collodion Process I am about to describe, and to the elucidation of which I am anxious to devote my attention in the present manual, has already, since I first introduced it in the spring of last year, produced many beautiful results; and the facility of its manipulation offers a valuable and ready assistant to the artist, and to those who are desirous of obtaining transcripts of nature, without the exaggerated drawing, and false light and shade, now so much adopted in the various illustrated works of the day.

Some persons express disappointment on viewing the productions of this art, because they do not find those sudden contrasts which are generally the exaggerations of the draughtsman, aiming at the improvement of his model.

The reverse of this ought to be the feeling

of the true artist, who should avail himself of these faithful delineations of nature to restrain the freedom of his pencil.

Many imagine that Photography may take the place of the painter's art, as more likely to give faithful portraiture, and correct views of character and detail; but it is not in this light that I look upon it as performing its true office, for the character and expression of the features are so continually varying, that in this, as in the painter's art, the same watchfulness and observation of character are necessary, and the same artistic arrangement is required.

A certain *general* expression must be sought for. Who has not observed too often in portraiture the want of that *general* expression? the absence of which mars the otherwise correct delineation of the features.

It is not my intention to enter into any detailed historical account of Photography generally, but to confine myself to matter relating to the Collodion process; and to give such instruction and advice in the manipulation, without entering into too much detail, as I consider will be of service to those who are for the first time about to work this process, and

who are but little, if at all, acquainted with the art generally.

It will, however, be as well to say a few words in reference to the various experiments which led me to adopt collodion as a material so well adapted for receiving the chemical agents necessary in this beautiful art.

In the account I published in the "Chemist" of March last year, the difficulties attending the use of paper were spoken of as being too great ever to be overcome, on account of the unevenness of its texture, and other defects.

These considerations eventually induced me to abandon its use, and seek for some other substance equally applicable; and it certainly is remarkable, that a material which may be called a modification of paper, should be found so well to answer the purpose required.

My first attempts with collodion were directed to the improvement of the surface of paper, by spreading over one side a thick solution of collodion.

These essays were not successful, for after the necessary washing, &c. in the process, the collodion film did not adhere to the paper sufficiently to be of any use.

However, previous to and during the progress of these experiments, I was trying various other substances as media, for holding the chemical agent—Zyloidin, other modifications of starch, extremely fine paper pulp, tannogelatine solutions, and several combinations of albumen. Each had its turn, and it was only after repeated experiments in numerous ways that I decided on collodion, as being the best, and at the same time the most available substitute for paper. Its exceeding ease of manipulation, and the brilliancy of the pictures obtained with it, cannot fail to strike every one who sees them; and justifies me in the opinion I entertain of its great value and practical importance.

The strength of the film allows the removal of the drawing from the glass on which it has been produced, and this is a most distinctive feature in the process.

The readiness with which the film can be produced on glass, without the previous preparation so tedious in other processes, also gives it great practical value, particularly to those who have not much leisure to devote to the art.

It is difficult to say who first attempted to use collodion in photography, and it will hardly be a matter of much importance to pursue this inquiry; but the first publication in which it was alluded to, was that of M. G. le Gray, of Paris, and then only incidentally, as a substance which might possibly be made available.

There is no doubt that many tried it previously to this, but as their experiments produced no results, and led to no practical end, their claims to the first use of collodion cannot be considered of much value.

FRED. SCOTT ARCHER.

14th March, 1852.

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INTRODUCTION.

The power possessed by solar light, and in a less degree by artificial light, in producing chemical change in the various organic and metallic compounds of the earth, has excited the attention of the most able chemists and philosophers of the day.

For several centuries the darkening effect of the solar rays on chloride of silver has been remarked.

More recently Sir Humphrey Davy and Mr. Wedgwood turned their attention to this curious subject, and endeavoured, but without success, to apply it to useful purposes.

Since their time, however, and from these small beginnings, a new art has been discovered, beautiful in its results, commanding equally the attention of the artist and the man of science.

The former will avail himself of it for noting down the aspects and changes which are constantly varying the face of Nature, opening to his observation many striking effects of light and shadow, which, without its aid, would altogether escape his observation, or elude the vigilance of his pencil to note down.

The chemical philosopher will find in it a new study and wide field of research open to his view; presenting, in fact, an entirely new branch of chemical inquiry; and he cannot fail to be struck with the great power which a very feeble ray of solar light has, in producing a rapid chemical change in some bodies when presented to its influence; the consideration of which may induce him to devote some portion of his time to the investigation of a subject so interesting in its details and marvellous in its effects.

He will also observe how very large a portion of the solar rays, though not absolutely necessary to illuminate and brighten the face of the natural world, are not less essential to our well-being, and are silently working with powerful effect in producing remarkable

changes, and modifying by their influence the most enduring, as well as the most fragile of nature's productions.

Moreover, it is to be hoped that these investigations, and the increasing interest which the Photographic Art generally is acquiring, will induce the chemical manufacturer to direct his attention to the preparation of chemical products hitherto little in demand, which are now being sought for; and unfortunately, in too many instances, cannot be obtained of sufficient purity, or at such a price, as would warrant their immediate use in the art.

It is an important point to consider, that it is useless for Photographers to endeavour to increase the energy of their sensitive surfaces, when the chemicals required are not manufactured with that purity and exactitude so absolutely necessary to ensure their success.

These remarks are not made from an over-fastidious idea of the importance attached to this branch of the subject, but from a certain conviction that no good results can in future be produced with certainty, unless the manufacture of Photographic chemicals is

treated in the laboratory as more worthy the consideration of the operator.

It is to be hoped that some one with ability and zeal will come forward and offer to the photographic world such a certainty of procuring pure chemicals, that this difficulty may not in future retard the progress of the art, or damp the ardour of its votaries.

THE COLLODION PROCESS.

Although it is not my intention to enter into any detailed account of the chemical preparations used in this photographic process, still I am anxious to offer a few remarks with reference to the manner in which I consider the collodion solution can be best prepared, of suitable strength and firmness; for these two qualities must be considered indispensable, especially when large surfaces of glass are to be covered. When working with small quantities these two qualities may not be considered so important as they really are; and further, when the pictures are to be rolled up, or whitened with the bi-chloride of mercury solution, the

strength of the collodion is of essential importance.

My object is to promote the use of a strong and firm film, which will bear removal from the glass when this operation is considered necessary; and will equally well dry on the glass when the drawing is finished. I should first wish to point out the mode of preparing the gun cotton, and afterwards proceed to describe the collodion solution.

There are two receipts for making gun cotton, from either of which a good dissolving cotton may be obtained.

Several others have been described, but I should only be confusing the subject to attempt to give the whole; and it would be foreign to the limited purpose of this work to do so.

The results, however, vary so much with the strength and proportion of the acids used, as to render it extremely difficult to name any one in particular, which would entirely succeed under all circumstances. In all cases it is more easy to prepare a cotton which will explode readily, and yet *not be at all soluble*, than one which will entirely dissolve in rectified sulphuric ether.

Few will be able to avail themselves of these receipts, unless they previously possess sufficient knowledge of chemistry to ensure a tolerable hope of success, for it requires considerable practice and very many trials before a good cotton can be prepared.

I give them for the use of those, who are by circumstances placed in such a position, as to entail upon them the necessity of preparing it themselves, when the consideration of cost cannot be taken into account.

PREPARATION OF GUN COTTON.

Take of dry nitre in powder,	40 parts
Sulphuric acid .	60 "
Cotton . . .	2 "

The nitre, sulphuric acid, and cotton, are weighed in the above proportions, and placed near at hand, within reach of the operator, to prevent delay in mixing when the operation has commenced.

First put the powdered nitre into a basin placed *firmly*, so that there shall be no fear of its upsetting: it is necessary that this operation should be conducted either in the open air or in some convenient situation where

there is sufficient draught to carry off the nitric acid vapour generated. Then pour the proportion of sulphuric acid into the powdered nitre, stirring them well together for a few seconds, with a strong glass rod. Immediately the two are mixed add the cotton, having previously pulled out the fibres, and mix them well together with two glass rods, in order that the whole of the cotton may come in contact with the nitric acid vapour, which is being rapidly generated from the mixture.

This action must be continued for about two minutes; then quickly remove the cotton with the adhering nitre and sulphuric acid from the basin, with the glass rods, and plunge it into a large quantity of water; it is to be well washed in repeated changes of water until all the acid and nitre are washed away.

The cotton is then collected together and first pressed between the hands to drain off the water, and then still further dried by pressure in a cloth; the fibres of cotton can now be carefully separated and hung up with pins to the edge of a shelf or any other convenient place to dry. There is no necessity to use artificial heat, as the small quantity requi-

site for a few ounces of solution can easily be dried without it.

The next receipt is by certain proportions of nitric and sulphuric acids:

Take 1 oz. by measure of nitric acid, S. G., 1·450
1 oz. ,, sulphuric ditto ordinary
80 grs. by weight of cotton.

The fibres of cotton must be well separated as in the preceding mode. The two acids are first mixed, and the requisite proportion of cotton added as quickly as possible, and well stirred with two glass rods for not more than fifteen seconds: the gun cotton is removed from the acids, and plunged into water to undergo the same washings, &c. as in the former recipe.

It will be seen that the cotton is not exposed to the action of the mixed acids, in this last mode, longer than is necessary to saturate the cotton; should the action be continued further, the solubility of the cotton is entirely lost.

Water must not be spared in washing the cotton, for not a trace of acid should be left; the collodion would be injured by any remaining.

Preparation of Collodion.

It is not easy to give the exact proportions of gun cotton to be added to the rectified sulphuric ether to prepare the collodion solution, as this must depend entirely upon the strength and thickness required. In the ordinary way, it is better in the first instance to make a thick solution, and after having filtered off the insoluble portion of the cotton, to dilute the remainder when required for use.

It will be better for parties to depend upon their own experience after a few trials than to look for exact proportions in a recipe. By taking an ounce or two of ether, and adding the cotton by degrees, and well shaking between each addition, the solution can be tempered to any required thickness.

Also the thickness of the collodion must depend upon the skill and dexterity of the operator, and the season of the year.

In the commencement of the practice of this process the amateur should be careful not to use a very thick solution, especially if the weather be warm, as the quickness of the eva-

poration and the necessary slowness of his movements would render it unmanageable in his hands.

These considerations render it difficult to recommend any fixed and exact proportions, but whatever may be the thickness of the solution, great care should be taken to obtain a collodion, which will, when evaporated on a surface of glass, be sufficiently strong to bear removal when necessary.

This must be considered a most important point; for otherwise, if the film is weak, it cannot possibly be expected to bear the washings and various changes the operator may wish it to undergo.

The strength of this film can be tested in a general way, by pouring a small quantity on to a piece of glass, and when the surface has set a little, removing the film as a thin and delicate skin. This can be done by taking the edge of it between the fingers, and gently removing it from the glass.

If the collodion is sufficiently strong, it will bear in this way almost entire removal from the glass. The sensibility of the collodion to light is also very much influenced by its

strength or weakness. And it may be considered as a general rule, within certain limits, that the weaker the collodion the more sensitive it will be to light.

In this view of the matter, it is consequently necessary to avoid the two extremes, of a very strong film or a very weak one.

The reason of this I will endeavour to explain. The quantity of solution of iodide of silver which a certain solution of collodion can be made to take up, depends in a great measure on the quantity of alcohol in the collodion; and it will be found that if the collodion is very strong, it cannot be made to take up much iodide of silver, but by adding alcohol, it is possible still further to iodize the solution. However, this can only be done by sacrificing the strength of the film, for the more alcohol you add to the collodion, the weaker it must become; and this arises not less from the addition of alcohol than from the much larger quantity of iodide of silver in the film, which the addition of the alcohol gives it the power of dissolving.

To Iodize the Collodion.

The next step is to iodize the collodion. In the first place, a solution of iodide of silver, dissolved in an alcoholic solution of iodide of potassium, must be prepared.

The mode I gave in my first account of the collodion process, in the March number of the "Chemist" for 1851, is the most ready way of obtaining this solution.

Prepare a saturated solution of iodide of potassium in alcohol, say 1 oz., and add to it as much iodide of silver as it will take up. Or to 1 oz. of alcohol add an excess both of iodide of potassium and iodide of silver; after a day or two, and with repeated shaking at intervals to facilitate the operation, a saturated solution of the two salts will be obtained, and if this is filtered off into another bottle it will always be found ready for use. The first bottle can be kept as a stock bottle, to obtain a still further supply by replenishing it with alcohol, and adding now and then small additional quantities of the two salts.

The iodide of silver can be readily obtained

by precipitation. For instance, take 1 oz. of solution of nitrate of silver used in the process, 30 grs. of nitrate of silver to 1 oz. of water, and add to it sufficient of a solution of iodine of potassium in water as will throw down the whole of the nitrate of silver as an iodide. When this precipitated iodine of silver has settled, which it very readily does, the liquid above must be poured off, and fresh water added, repeating this washing several times.

The iodide of silver after this is nearly dried, and then put into a bottle with a small quantity of alcohol just sufficient to keep it moistened. The quantity of this solution of iodide of silver which can be added to 1 oz. of collodion must depend upon the quantity of alcohol in the collodion, as I have previously remarked; so that exact proportions cannot be given; but with ordinary care and a little caution there will be found no difficulty on this point; and if, after having put, say, 5 drops of the solution to 1 oz. of collodion, it is found weak in colour, more must be added until the requisite density is obtained, which can be judged of by pouring a little on to a slip of

glass and dipping it into the nitrate of silver bath.

The collodion cannot be used directly after iodizing: the drawing made with it would be full of spots: it requires at least a day to settle; and great care must be taken afterwards not to disturb any sediment there may happen to be at the bottom of the bottle. The solution should be kept in a cool place, especially in summer.

Having now given directions for the preparation of the iodized collodion, I will proceed to describe the manner in which it can be used to most advantage.

Since I first published the process various modifications in the manipulations, and strength of the solutions, have been suggested; as, however, they do not differ materially from the original mode, there will be little gained by giving them in detail.

A small quantity of bromide or fluoride of potassium, or of arsenious acid, may be added to the solution. However, they do not accelerate to any great degree.

A stronger solution of nitrate of silver may be used at times with advantage, as it

would tend to increase the sensibility of the preparation, but it would be liable nevertheless to dissolve out the iodide of silver from the film, when immersed in it, unless a small quantity of iodide of silver be previously dissolved in it.

This peculiarity will be best shown by the following experiment: Prepare a strip of glass with collodion; iodize it in the nitrate of silver bath, and afterwards allow it to dry, placing it at a small angle against any support. Presently, from the evaporation of the silver solution on the surface of the film, the iodide of silver will be gradually dissolved out, leaving the collodion film colourless and transparent. It will thus be seen, that although the weak solution has not this power, it acquires it at once by evaporation.

The advantages gained by using a stronger bath of nitrate of silver do not, in my experience, counterbalance the increased expense. I shall, therefore, give the old proportions, 30 grs. nitrate of silver to 1 oz. of water, as being the most economical and giving the least trouble.

It is not necessary to protect this solution from the light. By careful filtration now

and then it may be used for twelve months without having lost any perceptible strength.

Before I proceed further with the details of the process, it will be well to enumerate a few precautions. It is not necessary to have plate-glass, especially when the pictures remain on the glass; good flatted crown I have found to answer very well when small surfaces are to be covered. Any kind of glass, however, which is free from scratches or specks, will answer the purpose, although, when the pictures are to be removed during an excursion, a better kind of glass must be obtained, as a surface free from any blemish, and well polished, is indispensable, in order that the film may be removed with ease. With care the same glass can be used for a great number of pictures, if its polished surface is well preserved.

It is advisable to have the glass cut about half an inch longer than the drawing to be made upon it, as a kind of handle, to prevent the fingers touching the film. The collodion is not poured entirely over the glass—the upper portion is left uncovered; with this precaution a greater facility in working the process is ensured, and there is less fear of spoiling a good

drawing with finger marks or other imperfections.

The next precaution has reference to cleaning the plates of glass. After a time it will be found a source of much annoyance and failure, if great care be not taken to keep separate the cloths used in the various stages of the process. For instance, if, after fixing a drawing with hypo-sulphite of soda, the hands are wiped on any particular cloth, and it should be used afterwards for cleaning a plate of glass, there is every chance that the drawing made upon it will be spoilt; for the hypo-sulphite of soda forms with silver a sweet gummy salt exceedingly difficult to remove from the glass, unless it undergoes a thorough washing. It will be likely to produce a streaky deposit, which entirely mars the otherwise good effects of the picture, and unfortunately it cannot be discovered until the whole process is completed.

This inconvenience may not often occur to those who have an ample stock of materials, and can throw aside a number of plates of glass to be washed at leisure; but many who are limited in means, and consequently wish to make the most of a limited supply, cannot

neglect this precaution with any hope of success.

In my own practice of the process, when on an excursion, I never take less than three cloths with me—one to remove the excess of moisture from the glass, the next to partially dry it, and the third to give it the final polish, just previous to the preparation of the film; an old soft silk handkerchief will be found useful to give the last polish.

It will be well to keep the different stages in the manipulation of the process distinct from each other, in order to prevent confusion. They may be divided into five sections.

The first division treats of the preparation of the film of collodion on the plate of glass.

The second, the submitting the prepared plate to the nitrate of silver bath.

The third, the exposure of the plate to the action of light in the camera.

The fourth, the development of the image.

The fifth, the fixing of the drawing, &c.

The preparation of the Collodion Film.

The first division.—Take the plate of glass in

the left hand, holding it by one end, and with the bottle of collodion in the other hand, pour from it on to the middle of the glass such a quantity of the solution as will run in a body *freely*, and by gently tilting the glass from one corner to the other the collodion will run evenly over the surface, excepting the half inch at the upper end. When covered the residue is poured back into the bottle by inclining the corner of the glass nearest to it over the neck, and allowing the collodion to run off. The precaution, however, must be taken at this time to move the glass vertically backwards and forwards over the neck of the bottle, to prevent the furrowed appearance the collodion will assume if this is not attended to, and which in some measure will injure the delicacy of the drawing.

After a few trials the operator cannot fail to conduct this part of the manipulation with sufficient dexterity to obtain the desired evenness in the coating. After this, the glass, more particularly in cold and damp weather, should be allowed to dry for a short time, until, in fact, the ether has evaporated, and the film is damp only with the alcohol remaining in it.

Immersion in the Bath.

The second division. — The plate of glass prepared as above, and partially dried, is next submitted to the action of the nitrate of silver bath of the following strength:

Crystallized nitrate of silver	30 grs.
Water.....	1 oz.

This is an operation of much nicety, and requires a steady hand and some little care. The plate is held firmly in the hand, and plunged *at one motion* into the bath; otherwise, if any halt is allowed, a line will be produced across the plate, however short a time the stoppage may be.

It should remain in the bath about one minute, for the double purpose of saturating the film with iodide of silver and removing the oily or streaky appearance from its surface; which latter effect would, if allowed to remain, cause an unequal sensibility in the coating, and consequently an unequal development of the image, which nothing can afterwards efface.

In my own practice of the process, I generally find it more convenient and cleanly to use a glass bath, so contrived as to allow the

light to act upon the prepared plate whilst in it, and during the saturation of the film; consequently the two operations are conducted at the same time. The prepared glass, therefore, need not be removed from the bath until the light has performed its part, and the development of the image can be proceeded with.

The contrivance for this purpose with the glass bath is very simple, as it merely requires that the inside of the front glass of the bath should be adjusted to the same plane in obtaining the focus as the ground glass screen.

Thus, as I have said above, the saturation of the film and the action of light are going on at the same time. This plan, particularly with large plates, ensures more certainty in the operations. There is also less liability of the film becoming stained or injured by contact with the sides of the frame into which it is placed in the camera.

It is possible, however, that this plan, although it offers many advantages, cannot be made available, from the difficulty of procuring the kind of bath it requires. I shall, therefore, defer any further remarks on this point until I come to speak of the Camera, and proceed with

the manipulation, employing the old plan of placing the plate after removal from the bath into the previously adjusted frame of the camera.

Exposure of the Prepared Plate to the Action of Light.

The *third division* in the process consists in submitting the sensitive film *immediately* it is removed from the bath to the camera action. It will be a saving of time if, whilst the plate is in the bath, the focus and the adjustment of the sitter (if a portrait is to be taken) are attended to, for it is necessary, as I have just said, that the prepared plate should be submitted to the light directly it is taken from the silver bath, as its sensibility diminishes rapidly.

The length of time necessary to expose the plate in the camera, it is obvious must depend both upon the power of the lens and the intensity of the reflected image; and as the time may vary from one moment to a quarter of an hour, it would be useless to give any precise directions; the operator's own experience, after a time, will be his best guide. If a positive image is required, less exposure in

the camera is necessary; on the other hand, a negative, to print from, will require longer exposure, as considerably more body in the resulting deposit must be accumulated, for it is by means of the varying thickness and density of the shades the requisite effect in the after printing is produced.

It should be decided before exposing the plate in the camera, whether a positive or negative drawing is desired, in order to vary the time of exposure accordingly.

The Development of the Image.

The fourth division.—After exposure in the camera, nothing is visible on the glass. The image must be developed.

This operation is nothing more than making visible to the eye an exceedingly faint and delicate picture which the light, reflected through the lens, has impressed upon the surface of the film; it is, in fact, a continuation of the action of light, which action is the commencement of the reduction of the iodide of silver contained in the collodion, to the metallic state, carried on when thus commenced in the camera, by the reducing agent employed.

This effect is most apparent when a layer of albumen on glass is employed to hold the chemical agents, when it very often presents more the effect of plating by mechanical means than the result of the apparently feeble action of a ray of light.

There are many chemical salts possessed of this power, of reducing the salts of silver when in solution to the metallic state.

The salts generally employed are pyrogallic acid, proto-nitrate and proto-sulphate of iron.

The great power shown by pyrogallic acid in bringing out the latent image, was first made known by me in a short description, in the May number of the "Chemist" for 1850. I then pointed out a mode of using it, so as to produce an exceedingly sensitive surface; in that formula, however, acetic acid was the solvent, both for the nitrate of silver and pyrogallic acid solutions. Even then its action was very energetic, requiring no after wash to bring out the image; it is also equally rapid when used in connexion with a surface of albumenized glass.

I will give the formula for pyrogallic acid;

the other two agents named above may require a few words presently:

Pyrogallic acid	3 grs.
Water	1 oz.
Acetic acid	1 dr.

Mix the water and acetic acid first, then add the pyrogallic acid.

Take a small quantity of this solution in a porcelain cup or glass measure, kept expressly for the purpose, and pour it over the prepared glass immediately after removing it from the camera. This should be done with a quick motion of the hand, in order to facilitate its spreading equally, and at once, over the whole surface of the glass. If the plate should be very dry, after exposure in the camera, a slight immersion in the bath, before throwing on the developing liquid, will be of advantage.

The development must not be continued after the liquid floating on the glass has changed colour or deposited any sediment. The drawing would be injured if the action is continued thus far. If the image is not produced sufficiently strong before this decomposition comes on, it may be considered an indication that the exposure in the camera has been too short;

and suggests its own remedy in the next trial.

The production of the image with the proto-nitrate of iron, can be conducted in the same manner as with the pyrogallic acid solution, taking care to add just sufficient acetic acid to the proto-nitrate to cause it to flow freely on the glass.

The proto-nitrate of iron, as prepared by the action of weak nitric acid on iron filings, is a good developing agent; but there is one difficulty attending it, which at times will be felt a serious bar to its use.

It is the impossibility, commercially speaking, of obtaining it as a crystallized salt; and being an easily decomposed solution, it would not be convenient to prepare by this means any large quantity at once, certainly not more than sufficient for a day or two's consumption.

My own experience, resulting from some experiments recently made, is more favourable to the preparation of a solution in definite proportions of the two salts, the proto-nitrate and proto-sulphate of iron, than the use of either separately.

Crystallized nitrate of baryta and proto-sul-

phate of iron are easily obtained, and a sufficient quantity of each can be carried with the other chemicals, when about to make an excursion of any length. The small quantity of the mixed solutions of proto-nitrate and sulphate of iron, required for immediate use, can be made just previous to the commencement of operations.

Make a solution of nitrate of baryta 40 grs. to 1 oz. of water; when dissolved add to it 50 grs. of proto-sulphate of iron in powder; stir the mixture with a rod, and when the sulphate of iron is all dissolved, allow the precipitated sulphate of baryta to subside; when the liquid above becomes clear, it is ready for use. It is a solution of proto-nitrate of iron, with a small quantity of sulphate of iron. Add to every ounce of this about $\frac{1}{2}$ a dr. of acetic acid.

Fixing the Image.

Fifth division.—When the development has continued a sufficient time, and the picture has acquired its full perfection and depth of tone, it is slightly washed with water, and a small quantity of a strong solution of hypo-sulphite of soda is poured on from a cup kept for this purpose. The hypo-sulphite must be poured

off and on for several times in succession, giving the plate a little motion to facilitate the liquid penetrating the film. It will very soon begin to dissolve out the undecomposed iodide of silver, removing as it were a kind of veil from the picture which previously concealed its details.

Hypo-sulphite of soda may not be at hand; should this be the case, a weak solution of iodide of potassium can be used to effect the fixing of the image and removal of the iodide of silver.

A saturated solution of common salt will be found also to fix the drawing, although it will not dissolve out the iodide of silver, and may be useful when the two preceding salts are not at hand.

When the action of the fixing agent has been continued long enough, which is indicated by the entire removal of the milky appearance of the film, the drawing is well washed in water, or water is poured over it, if the surface is sufficiently strong to bear this mode.

A careful washing is necessary, for not a trace of hypo-sulphite should be left on the film, as its presence would cause an obliteration of the image after a short time. When properly

washed, it is dried at the ordinary temperature, and can afterwards be varnished and mounted, as the taste and means of the operator may suggest.

In working this process, too much care cannot be taken to protect the surface of collodion, after immersion in the nitrate of silver bath, from the action of diffused daylight or the too near application of the light of a candle or lamp. For it is, when first removed from the bath, susceptible of very weak impressions, and very many of the failures and disappointments of beginners, there is no doubt, arise from this cause. A certain disagreeable haze will appear all over the drawing, quite different from the marks and streaks produced from the use of dirty or imperfectly cleaned glass.

The above description includes the whole of the process as originally published by me in the "Chemist."

Although the details of each division may appear tedious and unnecessary, and perhaps are so to many, still, as guides for those who are for the first time entering upon the practice of Photography, they will rather be thought wanting in minuteness than otherwise.

The Whitening Process.

The picture being thoroughly washed in plenty of water, after fixing with hypo-sulphite of soda, is treated in the following manner.

Prepare a saturated solution of bi-chloride of mercury in muriatic acid. Add one part of this solution to six of water. Pour a small quantity of it over the picture at one corner, and allow it to run evenly over the glass. It will be found immediately to deepen the tones of the picture considerably, and the positive image will almost disappear; presently, a peculiar whitening will come over it, and in a short time a beautifully delicate white picture will be brought out.

The negative character of the drawing will be entirely destroyed, the white positive alone remaining. This picture after being well washed and dried, can be varnished and preserved as a positive; but nevertheless, even after this bleaching, it can be changed into a deep-toned negative, many shades darker than it was originally, by immersing it, after a thorough washing, into a weak

solution of hypo-sulphite of soda, or a weak solution of ammonia. The white picture will vanish, and a black negative will be the result.

It is very singular that the picture can be alternately changed from a white positive to a black negative, many times in succession, and very often with improvement.

Thus, by the above process, a most perfect white positive or a deep black negative is produced, quite distinct from each other.

In the first part of this after-process it will be observed, that the effect of this bi-chloride of mercury solution is to deepen the shades of the picture, and this peculiarity can be made available to strengthen a faint image, by taking the precaution of using the solution weaker, in order that the first change may be completed before the whitening effect comes on.

The progress of the change can be stopped at this point, by the simple application of water.

The Camera.

From the commencement of my labours in Photography, the difficulties appertaining to the working of the art with ease and simplicity induced me to turn my attention to the construction of an apparatus which should obviate, in a great measure, the uncertainty so frequently experienced.

A camera, therefore, which by its proper form and adaptation to the requirements of the art assists the operator in his labours, canno but be considered a valuable adjunct to his stock of apparatus.

The camera as now generally constructed is adapted for home work, and will do well enough for that, when everything required is near at hand, and can be made available; but there are times when an excursion is contemplated to some distant scene;—with this object in view, what is to be done? According to the present procedure, a stock of paper, or albumenized glass, is prepared beforehand; its sensibility must be kept down to avoid spontaneous change, during the interval

between its preparation and final development, for the attempt to prepare a very sensitive surface, and expect it to keep any time, is out of the question, as being contrary to all practical experience. Besides the above, various other precautions must be taken: but with all this care and preparatory labour, too often the operator returns home with blank sheets of paper, or imperfect drawings. The tedious delay which the long exposure of each sheet of paper, or of albumenized glass, requires in the camera, becomes, after a time, laborious and irksome.

This mode of proceeding has always appeared to me to be nothing less than meeting a difficulty half-way; which, with the proper construction of the apparatus, might be entirely overcome.

Many will meet these observations by saying that views of landscapes, or buildings, do not require such very sensitive surfaces, to obtain their correct form and delineation; and therefore, it matters not how long the exposure in the camera may be, as the result will be equally good.

But what progress shall we make towards

bringing the art to perfection, if the possibility of obtaining the *moving*, as well as the still-life portion of the scene, is not kept in view, as being one great difficulty to be overcome? For instance, a landscape without cattle, or other moving object—what is it but a melancholy affair? And an art which leaves out, as it were, the life of the scene, cannot be considered to have arrived at that perfection, which it should be the object of its promoters to ensure.

Description of the Camera.

I will proceed to give a general description of the camera I have constructed, premising that it admits of being made as a very light folding camera, if thought necessary.

It is a wooden box, 18 inches long, 12 inches wide, and 12 inches deep, and is capable of taking a picture 10 inches square. Externally it may be thus described:—In front it has a sliding door, with a circular opening in it, to admit the lens: this sliding door enables the operator to lower, or raise, the lens, and consequently the image formed by it, on the

ground glass, as the view may require. The two sides have openings cut in them, into which sleeves of India rubber cloth are fixed, to admit the hands of the operator; and are furnished with India rubber bands at the lower ends, which press against the wrists, and prevent the admission of light.

The back of the camera has a hinged door, fitted at its upper part with an opening of just sufficient size for the eyes, and shaped so as to fit close to the face. A black cloth is tied round this end of the camera, to prevent any ray of light penetrating at this opening. In the top of the camera near the front is inserted a piece of yellow glass, to admit a small quantity of yellow light, and is closed with a hinged door to regulate the quantity of light required.

The interior of the box is furnished with a sliding frame, to support the ground glass or the bath and the prepared plate; and it has a stop, by means of which any focus from 3 inches to 15 inches can easily be obtained.

The bottom of the camera is furnished with a gutta percha tray, about 1 inch deep, to hold

the washings, &c., when the camera is in operation.

Also, the bottom of the camera at the back has an opening cut in it, extending nearly the whole width of the camera, and as far in as the edge of the gutta percha tray.

This opening is intended to admit, when the camera is in use, a light wooden case containing the glass bath, focusing frame, stock of glass, and paper required in the process.

There are various other little contrivances which I have not specified, such as a drawer for the pictures, a shelf for bottles, &c.

This form of camera will admit of the following manipulation. Having placed it upon a stand pointing to the object to be taken, the hinged door at the back is opened, and the bath is three parts filled with the solution of nitrate of silver; a plate of glass is then taken from the cell, and cleaned if necessary.

The collodion is poured on in the manner previously described; when the film has set a little it is immersed in the nitrate of silver bath, and the lid of the bath is closed down upon it. The next step is to obtain the focus with the

ground glass: this can be done whilst the collodion is becoming iodized.

After adjusting the sliding frame to the proper focal distance, the camera must be closed, and the rest of the process conducted by passing the hands through the sleeves, and placing the eyes close to the aperture in the back of the camera, and drawing the black cloth over the front of the head.

By the aid of the yellow light admitted from the top, the operator can carry on the rest of the process. The plate is now ready for the action of light, and is taken from the bath; or the bath itself, with the plate in it, is placed in the sliding frame. The refracted image is at once thrown upon the sensitive plate. After the requisite exposure, the plate is taken from the bath, and the picture is developed with the solution previously described. The progress of this operation can be seen by aid of the yellow light, keeping the eyes close to the aperture behind.

When, from experience, the picture is sufficiently brought out, a little water is poured on the glass to wash off the developing solution, and the drawing is partially fixed by the appli-

cation of a small quantity of a solution of common salt.

The drawing may now be removed from the camera without fear of being injured by light, and the remainder of the operations can be conducted outside the camera.

If the film is sufficiently strong to bear removal from the glass, the following procedure is adopted. The plate of glass is placed horizontally upon the back lid of the camera, which is hung so as to form a temporary table, and the film is loosened from the edge of the glass with a flat strip of glass; a sheet of damp paper is then placed flat on the drawing, and rather within its upper edge; the film is turned over the end of the paper, and a glass rod is placed just within the edge. The sheet of paper with the collodion in contact with it is now raised from the glass, and rolled up on the glass rod. When the drawing is entirely enclosed in the paper, the rod is removed, and the delicate film thus encased is put away into its proper receptacle, to be finally fixed and mounted at leisure.

The drawing thus rolled up can be preserved for months without injury, provided it is kept

slightly damp; and if each drawing is enclosed in another sheet of paper, its preservation is still further secured.

The advantages of a camera of this kind may be thus enumerated:

It allows the preparation on the spot of the most sensitive surfaces; their immediate use whilst the sensibility is at its maximum; the ready development of the image, and after fixing.

All these operations being carried on consecutively, the operator can, after the first trial, see what results the progress of his labours is likely to produce.

It gives him the power of shading off any portions of the view during the action of the light, by holding in front of the prepared plate and near the lens a moveable screen, or any flat piece of wood, as the case may require; thereby preventing the too rapid action and consequent solarisation of the distant portions of the scene. The spire of a church, for instance, pointing upwards into a bright sky, often requires this precaution to prevent its being entirely lost. Other instances of this

effect will readily suggest themselves to those at all acquainted with the art.

The camera can be made, with slight modifications, applicable to any other process on paper or glass, and of course obviates the necessity of any kind of portable tent.

Glass Bath.

The glass bath I have alluded to is thus contrived:

Two pieces of plate glass are cemented together at the sides and bottom. It tapers gradually from the top downwards, so as to form a wedge-shaped bath: consequently, when the prepared glass plate is immersed in it, the lower end of the glass comes nearly in contact with the bottom of the front glass of the bath; so that if the prepared plate, after touching the bottom of the bath, be pushed forward in the liquid, it necessarily comes in contact with the whole inner surface of the front glass of the bath. It will, therefore, be perceived that, by adjusting the bath frame in the camera to the same distance as the ground glass frame, the

correct focus will be obtained, and the bath, with the iodized film in it, can be put into the sliding frame; the refracted image from the lens consequently strikes upon the film through the front glass.

The Photographic Lens.

The amateur will find a good lens an indispensable item in his catalogue of photographic requirements. He can have either a single lens for a landscape, or a double combination, where rapidity of action is required, as is the case with a portrait.

The use of a lens combination of less than 7 inches or 8 inches focal length should be avoided; for the distortion attending the image formed by a lens of shorter focus than this, will interfere very much with the truthfulness and correct proportions of the picture. With a very short focal length, the relative size of the objects in a picture is rapidly increased or diminished, when they are removed but slight distances from any particular plane: consequently, a combination of lenses of less

focal length than that named above, should not be used.

For some time past I have devoted much attention to the construction of Fluid Lenses, in which the necessity of the flint glass lens is done away with, by the use of a fluid of such density and refractive power as will achromatize and correct the curvature of the crown or plate glass lens.

I have succeeded in the construction of such combinations, and can produce them of great power and flatness of field.

With them what are called the chemical and visual focii perfectly coincide; they do not therefore require the slightest adjustment in regard to these two difficulties.

I have used no other kind of lens for many years.

Summary of Precautions.

Keep separate the cloths for cleaning the glass, &c.

Be careful to clean the glass thoroughly.

Any cloth when once used for cleaning a

plate of glass after the application of the hypo-sulphite of soda should be kept for this purpose alone.

Avoid the too near proximity of diffused light, or that of a candle or lamp, unless it is shaded by a yellow screen of glass.

Take care that your solutions are put into bottles with lips.

Clean the stopper and neck of the collodion bottle after each day's use.

Avoid disturbing any sediment there may be at the bottom of the iodized collodion bottle; and if there should be much sediment, pour off the clear solution from it into a clean bottle for use.

Keep separate a cup or measure for the developing solution, as also one for the application of the hypo-sulphite of soda.

Keep clear all the solutions by filtration.

Conclusion.

In conclusion, I do not hesitate to say, that no one with ordinary care and forethought in procuring good chemicals, and strict attention to cleanliness in the different stages of the process, will fail to meet with success: and if after a little practice a fixed method in the arrangement of the various accessories required can be attended to,—keeping, in fact, everything in good order,—the whole process will be found a source of much pleasure. In the practice of no other process at present known, can such good results be obtained, with so little labour and cost.

That part of the process described at page 46, alluding to the mode employed for removing the drawing from the glass, is particularly adapted for the artist whose sole object may be to obtain sketches of nature with rapidity and ease, and to whom the labour of carrying a large stock of prepared glass would be an insurmountable objection to its use. By taking care to procure a good strong collodion,

this part of the manipulation may be conducted with ease after a few trials.

I wish it to be understood, however, that it is not at all necessary in the ordinary working of the process, to roll up, or in any way remove the pictures from the glass upon which they have been made.

When glass can easily be procured, or is at hand, it would obviously be taking unnecessary trouble to do this.

THE END.

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